B INDUSTRIAL PROCESSING ENVIRONMENT

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B1 INDUSTRIAL DEVELOPMENT

B1.1 THE STATE OF INDUSTRIAL DEVELOPMENT

B1.1.1 Overview of the industrial base and potential for industrial development: Large and medium companies

This section reviews the evidence on the state of industrial development, with reference to large companies, defined in the White Paper on SMEs as with more than 10 employees and either a turnover of more than N$1,000,000 a year or capital employed of more than N$500,000[1]. The evidence on small companies is reviewed in the next section.

For the purposes of the study the ISIC classifications will be used to classify different areas of concern and interest. **Table B1** below gives a summary of the types of industry most prevalent in Namibia, as classified by their ISIC numbers[2].

Table B1: Percentage shares of different aspects of the manufacturing industry

ISIC	Category	Number of establishments	Number of employees	Fixed assets	Value added
31	Food and beverages	41.7	69.4	78.6	76.6
32	Textiles and leather	6.5	3.6	0.6	1.2
33	Wood products	8.3	4.5	1.9	2.4
34	Paper products	7.2	4.4	2.4	2.8
35	Chemical products	8.6	4.2	5.7	6.8
36	Non-metallic mineral products	10.1	5.6	3.9	3.1
38	Metal products, machinery and equipment	14.7	7.6	6.8	6.8
39	Other	2.9	0.7	0.2	0.1
Total		**100**	**100**	**100**	**100**

Source: Ministry of Trade and Industry 1995

[1] These figures are for manufacturing, with the employment and turnover figures for other entreprises are half this and for capital employed N$100,000

[2] ISIC is an international standard for industrial classification.

Hence it can be seen that at present the sector is dominated by food processing[3]. Labour intensive sub-sectors are textiles, wood products, paper products, non metallic mineral products, metal products and "other products". Trends can only be inferred from the national accounts, which show a trend of 4% growth for each of the previous five years in non food manufacturing. An aspect of this data noted in a recent paper (Ramano et al 1998) is a split between industries catering for final consumption (i.e. food & beverages) and those producing intermediate goods, a sign of an interlinked economy, such as chemicals, metals and machinery. The presence of the second group indicates a degree of inter-industrial linkages, which is a positive sign for future growth since the expansion of industry will be able to draw upon domestically manufactured goods. In addition their labour intensity means that they will produce reasonable numbers of new jobs.

Table B2: Growth rates (%) in manufacturing since 1990

	1990	1991	1992	1993	1994	1995	1996	1997
Meat processing	2.9	2.8	2.7	2.6	2.8	2.7	2.6	2.5
Fish processing	36.9	-27.7	48.4	31.9	9.0	0.2	-35.2	26.4
Other manufacturing	3.5	1.8	1.9	4.0	4.0	4.0	4.0	4.0

Source CSB: 1998

The fish processing sector is extremely variable, reflecting the variability of fish quotas issued by the government. By contrast the rest of manufacturing has fairly stable growth mainly driven by domestic demand[4].

Since the food and beverage sector is so dominant it is examined in more depth. Within the food and beverage sub sector the breakdown is as follows:

[3] CSB figures imply that in 1993 only 32% of value added was in fish and meat. In this sample fish and meat are 61% of food/beverages which are 76.6% of total, hence 47% of value added. Using the Census proportion of value added by fish and meat in 1993 and the CSB total implies that food and beverages are 53% of value added.
[4] This is based on the fact that exports of "other manufacturing" and "meat products" are growing slower than these sectors. This may be changing judging from interviews with manufacturers.

Table B3: Value added and establishments in the food and beverages sector

Within food and beverages sub-sector	Establishments	% of total value added 1994
Meat slaughter & preparation and preservation	29	13
Canning, preserving and processing of fish	20	39
Manufacture of bakery products	36	2
Manufacture of other food products	25	32
Beverages	6	14

MTI Census: Note excludes businesses with less than 10 employees

These figures indicate that within the food and beverage sector there is a reasonable degree of diversification. Several large manufacturers in the food and beverage sector visited are expanding production for export, mainly based on the South African market. Since the South African economy is approximately fifty times the size of the Namibian economy the potential to increase production through exports for these companies is vast.

Hence we have a picture of manufacturing industry heavily dominated by a few sub-sectors. These themselves are dominated by a small number of firms in specific areas of production such as fish processing. However a recent analysis of the manufacturing industry implies that a degree of diversification occurred in the late 1980s and early to mid 1990s (Ramano et al:9).

Investor perceptions have changed since1990 so that Namibia is now seen as much less risky from a political point of view, and that the main problems are now seen to be labour relations, lack of skills and cost of inputs. Investment in manufacturing has recovered since 1990 to around three to four times the 1990 level in recent years.

The EPZ programme has taken off since 1995, with the establishment of EPZs in Oshikango, Walvis Bay, Windhoek, Swakopmund, Keetmanshoop, Mariental, Tsumeb and Okahandja. The rate of investment in EPZs has been reasonable, with around 58 companies registered by mid 1998, This has led to around N$190 million of

investment, creating around 1300 jobs so far with around N$935m of investments approved by mid 1998, with a fully operational employment of over 3000 (ODC Annual Report 1997). These companies are in diverse manufacturing sectors, and as can be seen below are not in the traditional food and beverages sectors but are diverse with a substantial number based on metal and chemical products. This means that fluctuations in the economy are reduced due to lower reliance on any one sector or any one market.

Table B4: EPZ investments as of mid 1998

Sectors	% of jobs	No. of firms
Food and beverages	4	3
Textiles and leather	10	6
Wood products	17	3
Paper products	0	0
Chemical products	20	10
Non-metallic mineral products	3	2
Metal products, machinery and equipment	23	15
Other	23	12

Source: ODC Annual Report 1997 and unpublished ODC data from mid 1998.

Note that classification of sectors is approximate.

The government, in addition to a policy of creating a generally enabling environment for manufacturing and foreign investment, has recently commissioned a study on Namibia's potential growth industries, which outlined areas of potential, summarised in **Table B5**.

Table B5: Areas of potential growth in the Namibian economy

Sector	Sub-sector	Priority products
Fish	Processed fish	Horse mackerel, tuna, orange roughy, tooth fish
Agriculture	Horticulture Cotton Tobacco Meat & products Karakul pelts	Grapes, melons, dates, asparagus
Minerals	Metals Industrial minerals	Copper, zinc, gold, dimension stone, white fillers
Manufacturing and miscellaneous	H&S and leather Crafts Products for regional markets	(inc. cow, sheep & seal) Handwoven carpets

Note: From Ramano:45 and Industrial Policy Beyond 2000 White Paper

While this concentrates on the existing potential raw products it appears from the discussion above that this study has been too conservative in its predictions of Namibia's manufacturing potential.

In conclusion the large scale manufacturing sector is gradually diversifying by types of products. This includes diversification into sectors based on metals and chemicals which are more complex and have a linkages to other parts of the economy. If EPZs take off on the scale promised by the companies that have been given EPZ status then the large scale manufacturing sector might start to grow rapidly and diversely.

B1.1.2 Overview of the industrial base and potential for industrial development: Small companies

Small and medium sized companies (SMEs) have a much less developed data base than large companies, because they rarely enter government statistics as taxpayers, employers or in other ways. There is a high degree of overlap here with the term informal sector, so here the two are used as if they are synonymous. Hence the evidence presented here is mainly anecdotal and qualitative. Contribution to GNP is estimated at 2-3% (quoted in Ramano et al:13). The sector also produces reasonable

amounts of employment, with around 33,000 people employed in it in the 4Os alone. Most commentators split the sector into micro entreprises, virtually always only employing one person or family, which are heavily involved in small scale brewing and trading, and SMEs themselves, which are more diverse. Micro entreprises operate in very crowded markets with very low margins and fairly similar products. Small entreprises include service providers (e.g. shops or laundry) and small scale manufacturers (e.g. wood carving). A recent analysis of a planned Entreprise Namibia programme found substantial differentiation by region, with much better access to capital and training and much better business management amongst businesses in the Oshakati area than in the Windhoek area (Emma Palmer pers.comm). Manufacturing is often seen by planners as one of the key parts of the SME sub sector to encourage. This is because its lack of crowding means that better incomes are available for the entrepreneurs and there is a potential to export to the almost unlimited world market in the long term and the large market of neighbouring countries in the short term. At present the manufacturing composition of the SME sector is small (around 4%: Ramano: 14), but has huge potential for growth. Government policy both promotes SMEs and large businesses, in line with the inconclusive evidence on which are most beneficial to promote from a social and economic point of view. SMEs have advantages due to their labour intensity, while large companies tend to have an advantage in exporting due to their ability to exploit foreign markets[5].

The Ministry of Trade and Industry recently conducted a survey in the 4Os of small businesses, which found around 36% of small businesses involved in manufacturing, as follows:

[5] For instance in the newly industrialised countries there are countries mainly based on very large companies such as South Korea and Japan, and countries mainly based on small companies such as Hong Kong and Taiwan (Wade 1990).

Table B6: Small businesses involved in manufacturing in the four Os 1997

Type of business	Number	Percentage
Beer and liquor brewers	4082	79.5
Basket makers	210	4.1
Open air butcheries	149	2.9
Builders	109	2.1
Tailors	63	1.2
Brick makers	41	0.8
Wood cutters/ sellers	40	0.8
Potters	42	0.8
Carpenters	32	0.6
Bakeries	31	0.6
Sewing groups	31	0.6
Welders	25	0.5
Wood carvers	12	0.2
Others	268	5.2
Total	**5135**	**100**

Source: MTI Small business baseline survey 1998.

Note numbers estimated from the sample based on a census of all manufacturing entreprises which provided the estimate of the percentage distributions. A second census of Erongo and Otjozondjupa is underway at present.

As can be seen from the figures in Table A? on the occupancy rates and uses of the SME modules and the survey examined above it seems likely that small scale manufacturing will continue to be in regions which already contain relatively large amounts of manufacturing. In addition most of the manufacturing will continue to be light industry. The level of diversification of entreprises in the north, as shown by **Table B6**, is extremely low. While there may be potential to increase enormously in these areas this will take time, given the small base, so the impact of small scale manufacturing in northern Namibia in the next few years is likely to be low.

B1.1.3 Implications for the SOE report

The following can be concluded for the next five to ten years. Namibia's medium to large scale manufacturing sector is small enough that growth over the next 5 years is likely to happen in sub-sectors which are already known well (for instance fish processing) or in limited geographical areas such as EPZs and a few urban centres. This is likely to create secondary growth amongst other manufacturers who provide inputs (for instance machinery) and small and medium sized entreprises, which provide both manufactures and services. Hence this report focuses on two key issues. These are:

- Food processing
- Waste products from other manufacturing

Manufacturing beyond food processing is so diverse (from jewellery production to tanneries to electrical goods assembly) that this study concentrated on its waste products in the areas where it is expanding and seems likely to expand in the near future.

These activities are expected to be concentrated in the following areas:

- Windhoek – Okahandja - Ojiwarongo
- Walvis Bay – Swakopmund
- Ondangwa – Oshakati - Oshikango

B1.2 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

The present policy environment is dependent on a few key pieces of legislation and policy, mainly from the MTI. Key pieces of policy are:

- White paper on industrial development (1992)
- Policy on SMEs (1998)
- Industrial policy beyond 2000 (draft 1999)

None of the incentives in place for manufacturers[6] directly promote activities that are harmful to the environment. However relative to their number chemical companies have been relatively significant in applying for manufacturing incentives[7]. This might be significant in the future for pollution trends.

The legislative framework is based on various incentives[8] and pieces of regulation:

- Foreign investment act (1990)
- Manufacturing incentives act (1993)
- Export incentives act (1994)
- Close corporations amendment act (1994)
- EPZ act (1995)
- Trade and occupational licenses repeal act (1995)
- Tender board of Namibia act (1996)
- Liquor act (1998)
- Companies act (1973)
- Offshore banking act (1998)
- Competition act (in draft)
- Environmental management act (draft 1999)

Essentially those emanating from the Ministry of Trade and Industry deal with providing incentives to the manufacturing industry and basic regulation of industry. For the purposes of this analysis these are not particularly important, except for their bias towards establishing industry in some areas. Of more interest are the policies and legislation concerning environmental problems.

[6] Based on summary in Ramano: 39
[7] Ramano: 41
[8] Ramano et al: 27

B1.2.1 Policy and legislation concerning the environment and its relevance

At present the only Policy of major importance is the Environmental Assessment Policy (Ministry of Environment and Tourism 1995). This essentially recommends that government and the private sector initiate Environmental Impact Assessments for projects, policies and programmes that could have adverse environmental effects. So far implementation of it has focused mainly on major projects through Environmental Impact Assessments, rather than policies and programmes which can be addressed through Strategic Assessments. This is important for Namibia since, even with Namibia's underdeveloped manufacturing sector, there were 278 establishments in 1993/4 with more than 10 employees. Although an environmental assessment will capture the consequences of a major project it will not examine the cumulative impact of a series of small projects.

Due to the need for a more strategic approach to environmental issues the Environmental Legislation programme of the Ministry of Environment and Tourism has drawn up a draft Environmental Management Act and a draft Pollution and Waste Control Act. The first will include provisions for legally binding people to undertake environmental assessments (although not to abide by them), for monitoring compliance to the principles of environmental management, and for strategic assessments. These will be monitored and enforced by a "Sustainable Development Commission". Strategic Assessments should help capture the unintended consequences of a policy. For instance if the SME policy leads to a large number of new small businesses it might examine the cumulative impact of these and suggest mitigatory measures. The second will establish a "Pollution Control and Waste Management Agency". This will regulate pollution in an integrated way, so that air, noise, solid and liquid wastes are dealt with. It will also regulate waste sites.

B1.3 INDUSTRIAL DEVELOPMENT AND GLOBAL INFLUENCES

The context of world markets for Namibia at present is unclear. The increasing numbers of countries across the world targeting export led growth means that competition for foreign investment is increasing. Furthermore a high proportion of foreign investment is into a very small number of countries, mainly in Asia and Latin America. A recent study of key reasons that attract foreign investment does not make cheering reading for Namibia[9]. These were:

- Market size seeking (e.g. market size and incomes)
- Resource asset seeking (e.g. raw materials, low cost unskilled labour, clusters[10], physical infrastructure)

In the context of manufacturing Namibia has very little to attract foreign investment beyond the processing of some minerals and a high quality infrastructure. However Namibia's small population means that quantities of investment which are very small in the global context could transform its economy.

B1.4 RAW MATERIALS USAGE AND SUSTENANCE OF ALL INPUTS FOR PROCESSING

A wide variety of raw materials are used by industry. However the use of these raw materials does not necessarily imply environmental damage if they are produced in an environmentally friendly way, including sustainability. This analysis focuses on water in particular due to its status as a scarce resource that is still subsidised to a great degree. The interviews conducted and the recent feasibility study for the Ujams ZERI project have confirmed the findings of previous studies (for instance DWA quoted in Lange 1997) that volumes of water used by industry are generally small. The three largest manufacturing water users in Windhoek are Meatco, Namibia Beverages and

[9] Finance and development. International Monetary Fund 1999.
[10] Areas where large numbers of companies in the same sector congregate such as Silicon valley.

Namibia Breweries, which together use less than 5% of total water use in Windhoek. Other manufacturers are insignificant.

B1.4.1 Food and beverages

B1.4.1.1 Fish processing

Fish processing water use is not well known. Groom et al (1999) found large use by one plant in Luderitz but with moves towards using sea water because of the cost. Water use by the major Luderitz processor was around 900,000 cubic metres a year. The DANCED sponsored project on clean technology in the fishing industry found that water use could be reduced by around 30% at fairly low cost. Using 1993 water use figures[11] (Lange 1997) and the high end cost of water use reduction (around N$546,000) the cost of reducing water consumption is around N$47 to reduce water use by one cubic metre per year. Given the increase in water charges towards cost recovery a cost of around N$5-10 a cubic metre is already being experienced by consumers. This suggests that even with high end costs assumed and no other savings from the introduction of the new technology it is close to being economically viable at present prices of water and effluent discharge[12]. Any introduction of higher water charges or charges for releasing effluent (particularly if related to its organic load) would certainly make the technology viable.

B1.4.1.2 Meat processing

Groom et al (1999) collected data for Katima, Okahandja, Otjiwarongo, Oshakati. Total use in these four plus Windhoek was around 500,000 cubic metres so less that 0.25% of aggregate water use in Namibia. It has also been reported by one large meat processor that over the last three to four years water use had been reduced by almost half for each unit of output through the use of heat exchangers. The DANCED project on the fish processing industry intended to broaden its activities to include

[11] Using 20 fish processing factories as a base there was a use of around 34,500 cubic metres a year.
[12] A 10% discount rate and a N$10 per cubic metre cost of water leads to a payback time of about 7 years assuming no operations and maintenance costs.

the whole food processing industry so as to use knowledge gained to reduce effluent and water consumption in the rest of the food processing industry.

B1.4.1.3 Beverages

The Oshakati Namibia beverages factory uses around 47,000 cubic metres which is about 2 litres for every litre of drink. However this statistic may be viewed with caution in the light of the fact that the Windhoek brewery which is meant to be one of the most advanced in the world (Redecker 1998) in terms of design to save water uses around 4 litres to produce every litre of drink. This equates to about 360,000 cubic metres in 1998, around 2% of Windhoek's water consumption. Tunweni breweries is ZERI using 9,000 cubic metres a year. Far North manufacturers in Katima uses around 100,000 cubic metres a year, in a context of abundant water. Rietfontein dairy uses 251,000 cubic metres but only 14% for the dairy itself. These figures indicate that while the beverage industry uses significant amounts of water the impact on its costs of higher water prices which are expected will not be significant. Even with a N$10 per cubic metre cost of water Windhoek brewery will only be spending 4¢ a litre on water. This indicates that drinks manufacturers as a high value added activity will be able to pay full cost recovery prices for water. The Windhoek Brewery is experiencing rapid growth at present, having almost doubled beer sales since 1990, with an increase of around 20% in 1998 alone.

B1.4.2 Textiles and leather

A recent report on the leather industry in Namibia indicates that there are not enough hides produced for the existing tanneries, leading to imports from neighbouring countries including Angola. (UNIDO position paper 1998). Cotton and other materials are mainly imported at present. Exotic leathers (e.g. ostrich) are mainly produced within Namibia from game farms. Controls by the Ministry of Environment and Tourism should prevent any problems with sustainable production of inputs. Water used by the proposed Oshakati tannery is a concern at 300,000 cubic metres per annum. In the long run though development of more water infrastructure in northern

Namibia should avoid any serious problems, as long as the developers are aware of the expected long run cost of water (Water State of the Environment report) and of disposing of hazardous effluents to an acceptable standard.

B1.4.3 Wood products

The main inputs are often imported from neighbouring countries. Although there is a system of licensing concessions for large scale extraction in Namibia At present the licensing of concessions has been halted so that future concessions are only awarded once a reasonably accurate local inventory has been undertaken. Hence only one concession exists at the moment, which is for 1000 cubic metres in Kavango. There is also an ongoing more approximate measurement by the national forest inventory project which has undertaken a survey for western Tsumkwe district and Caprivi and will finish the 4Os this year. There is some doubt as to whether small scale extraction of wood on communal land is undermining the sustainability of some aspects of the industry based on Namibian woods. Although in aggregate the total amount of carving done by small scale wood carvers is probably not significant (Barnes 1998; Hailwa pers.comm.) it may be wasteful when high quality wood which could be sold at auction for N$3-4000 is used for a carving worth only a few hundred dollars. In addition it may lead to shortages of suitable woods in particular areas. Forthcoming legislation may strengthen the ability of communities and the government to manage forests sustainably and efficiently, but unfortunately at present there is not much information on changes in forest composition and quantity over time (revisiting the current woodland inventory in a few years will allow this). The Okongo community forest reserve in eastern Ohangwena is already providing support to the residents of the area in managing their forest. There are also activities supporting community based management ongoing in Omusati. A study conducted in 1994 (UNIDO:76) found that most wood harvested was exported to South Africa without adding value. Hence an increase in the wood manufacturing sector could substitute for this and might not lead to an increase in the total amount of wood used.

Box: Wood stock versus use in Caprivi

The national forest inventory recently concluded that there was 35 million cubic metres of standing wood in Caprivi. Assuming a population of 100,000 and a net growth rate of 1% this allows a yearly harvest of 3.5 cubic metres per inhabitant. It seems unlikely that harvesting due to wood carving is anywhere near this[13].

Source: Chakanga unpublished data; NHIES 1993/4 for population inflated by around 3% a year (as suggested by 1991 census).

B1.4.4 Paper products

This category is mainly concerned with the processing of paper which has been imported since there is no paper and pulp production in Namibia. Most other inputs are also imported. The only producer known of who is planning to produce paper products (rather than print or cut them) has a projected net water use of 350 cubic metres a year, which is insignificant.

B1.4.5 Chemical products

This category mainly consists of imported chemicals which are mixed in Namibia, with only one company making chemicals to produce paint, mainly based on crushed marble (UNIDO:78). There is also some other small scale chemical production, but with few locally sourced inputs. There is some potential for increasing use of byproducts from meat including glue, candles and soap (UNIDO:78). In addition there is the sulphuric acid production based on local pyrites at Rossing mine.

B1.4.6 Non-metallic mineral products

These are mainly for the construction industry and so will expand with the economy as a whole. These use local river sand, imported quick lime, gypsum from near Swakopmund, limestone from near Otjiwarongo, clay for ceramics in Kavango and Caprivi, sodalite (all UNIDO 80). There have been complaints about the effect on the water supply of removal of alluvial sand in several areas including Caprivi, Brakwater and Seeis. Sustainability as such isn't a problem though, but side effects of extraction might be and should be dealt with under the Environmental Management Act. There is also the charcoal industry based on bush encroachment,

B1.4.7 Metal products, machinery and equipment

Metal products are mainly based on processing imported metals, with the possible exception of a foundary in Walvis Bay owned by Gearing. Some metals are smelted in Namibia, such as at TCL and Skorpion. Vehicle production is also based on imported components.

B1.4.8 Other

This category is very diverse including areas such as salt production, nail manufacture and swimming pool production. There are no obvious industries under this category which will have problems with the sustainability of their inputs.

B1.4.9 Summary

Key raw materials are:

- Fish

[13] A total fuel use of wood of 635,000 tonnes in 1996 (Klaeboe and Omwani DoF) equates to around 530 kg per rural inhabitant. Any average density of wood of less than 151 kg per cubic metre would allow sustainability if this is assumed to be the only use of wood.

- Meat
- Water
- Wood
- Metals
- Electricity

All of these can be produced or used for regional or global markets, and all can be used without serious problems if they are used sustainably. There are explicit policies in place to ensure sustainable use in fisheries. In water there is a general movement towards full financial cost recovery and the overhauling of the entire water sector, as spearheaded at present by MAWRD and the Namibia Water Resources Management Review. Meat originates in Namibia, and there are no concerns about an imminent depletion of the national herd. Electricity is mainly imported or produced at Ruacana. Again there are no sustainability concerns with electricity. The only input which may have serious sustainability problems is wood. All other inputs may have environmental concerns connected to them but these are much more associated with their production processes rather than pressure put on them due to manufacturing industry in itself.

In addition a large number of sophisticated components and chemicals are imported as inputs to manufacturing processes. However the author has come across no evidence that any inputs used in manufacturing are in themselves environmentally undesirable in except for in their role in a manufacturing process.

B1.5 INDICATORS

It is recommended that if indicators are chosen which are meant to reflect the positive side of manufacturing they are focused on those already suggested.

B2 INDUSTRIAL PROCESSING

B2.1 INFRASTRUCTURE: RELATIONSHIP BETWEEN LOCATION OF INDUSTRY AND INPUTS

Recent literature on the economics of industrial location has stressed the importance of economies of agglomeration, in other words the advantages to producers of locating where other producers are located[14]. This has two important implications for Namibia. Firstly manufacturing tends to be situated where manufacturing is already situated, in other words concentration of activity should be expected. Secondly the natural advantage to locating in one place (for instance Walvis Bay's attractions for the fish processing industry) can attract many other industries which have no particular reason to be in that place. The implication for Namibia is clear. Manufacturing will probably continue to be located mainly in Walvis Bay and Windhoek, although the market advantages of the Oshakati-Ondangwa area may lead to substantial development in those areas. Interviews with manufacturers in Windhoek confirmed that they were in Windhoek mainly due to its large market, with some influence of the infrastructure and the ease of travel to Windhoek for international visitors who might be interested in importing Namibian manufactured goods. In addition there will be continued development of a few manufacturing types which have few economies of scale (such as abattoirs) or where transport costs are high enough to encourage production in an area where the raw materials are (for instance minerals processing).

[14] Krugman 1998 "The role of geography in development" Paper for the Annual World Bank Conference on Development Economics.

Agglomeration: Positive and negative sides

Although it is generally agreed that agglomeration of people into large urban areas is an inevitable occurrence very little has really been researched for Namibia. On the positive side many aspects of infrastructure such as roads, clinics, schools and sewage systems can be provided more cheaply in urban areas. For instance since qualified teachers prefer to live in urban areas one doesn't have to pay them any premium on their salary to encourage them to stay, as happens in some countries. In Namibia the lack of such a premium results in virtually all qualified teachers living in urban areas. Many networks, such as electricity grids and roads, have a very low extra cost to someone using them compared to the fixed capital cost of them being established. Again this makes it much cheaper to provide them for urban areas. Similarly the standards of waste management in Namibia's largest towns, especially Walvis Bay and Windhoek, are vastly better than in small towns and large villages. This partly reflects the fact that it is much cheaper per head to provide these services. On the negative side there are two major problems. Secondly there is the social one of migrant labour, which is unpopular with the people who are forced to migrate in search of work. Secondly there is the cost of congestion, such as the rising cost of providing water to Windhoek. This is not necessarily large. Based on the State of the Environment report on water one can estimate a typical middle income person using 50 cubic metres of water a year, which will typically have a long run cost of N$4 higher than it would in a smaller town, hence giving a total extra cost of N$200 a year. This will in effect be paid by the employer, since they'll have to pay their employees this much extra, compared to what they would have to pay them if they relocated their businesses to a smaller town. The strong impression from interviews with manufacturers is that they would be willing to pay this given the many advantages of being in a large town.

B2.1.1 Food and beverages

Clearly most fish processing occurs in Walvis Bay and Luderitz due to the availability of fresh fish and convenient transport links to export markets.

Table B7: Location of fish processing by town

Town	No. of establishments
Walvis Bay	16
Luderitz	7
Windhoek	2

Source: A guidebook for manufacturers in Namibia

Meat processing is much more dispersed, reflecting both the wide availability of the raw product and the demand for fresh meat across the country. Around 20 towns across the country have large butcheries, with many more smaller and informal ones in existence. However the largest plants are in Windhoek, due to the market. Other food products are also very dispersed, see Appendix X for details. Only Windhoek has a substantial concentration of food processing, relating both to the market available and the need to transport perishable goods to the market rapidly. Beverages are mainly based on water, and milk which are both ubiquitous with imported fruit concentrates. It should be noted that several beverage producers have been willing to install their own equipment for treating water and to maintain water pressure, including by Namibia Breweries. It appears that the cost of these measures is not sufficient to offset the locational advantages offered by their existing plants.

B2.1.2 Textiles and leather

The siting of tanneries in the Windhoek and Swakopmund areas suggests that the availability of markets is the a key factor. Similarly both mechanised shoe factories are in these towns (UNIDO 1998:23). As with food processing the siting of textiles

and leathers is dispersed, with only one concentration which is that around 26 of 45 establishments are in Windhoek.

B2.1.3 Wood products

Wood products are again dispersed with a substantial concentration close to Windhoek.

B2.1.4 Paper products

Paper products are mainly confined to printing in Windhoek with virtually all other activities in Walvis Bay.

B2.1.5 Chemical products

Chemical products are mainly produced in Windhoek, with 19 out of 37 establishments in Windhoek.

B2.1.6 Non-metallic mineral products

These are dispersed with a strong relationship to raw materials reflecting the high cost of transporting these products (which are mainly clay related) relative to their value.

B2.1.7 Metal products, machinery and equipment

Metal products are mainly produced in Windhoek, with 46 out of 70 establishments in Windhoek. These are often producing inputs for other manufacturing so there is a strong advantage in being close to their market both to reduce transport costs and to be able to interact more closely with their customers.

B2.1.8 Other

These diverse industries are also mainly operating in Windhoek.

B2.1.9 Summary

Most manufacturing is located in Windhoek, with a few other centres with substantial numbers of establishments, mainly Okahandja, Swakopmund and Walvis Bay. This indicates the importance of markets and infrastructure to most manufacturing. This is confirmed by manufacturers themselves, who see the advantages of being close to the largest market in the country. The infrastructure that has been noted of great importance includes the international airport and the transport links to South Africa. Most of Namibia's exports at present leave by Walvis Bay (in the case of fish) or are not bulky (diamonds), meaning that transport from South Africa bringing in goods such as food and consumer goods return empty. One manufacturer noted that it costs around four times as much to pay for a truck to come from Cape Town to Windhoek as to pay for it to return, and is using that as a way of securing cheap transport of his product to South Africa. This illustrates the way that a large market tends to attract more industry hence causing itself to grow. Another consequence of the high transport costs is that several companies interviewed are increasing and diversifying production to substitute for imports from South Africa. Basic food manufacturing such as bakeries and abattoirs is very dispersed, mainly reflecting the need for fresh produce to sell by these businesses.

The only major concentration of industry outside Windoek is in Walvis Bay due to the fish processing industry. This brief analysis of industrial location indicates that the geographical areas chosen for focus are the correct ones.

B2.2 MANAGEMENT OF PRODUCTS AND BY PRODUCTS

Only one of the manufacturers visited, a chemical manufacturer, had a product which was in itself environmentally threatening. These were being stored and transported in containers which were SABS and ISO compliant. The company itself was part of an international company that has its own internal monitoring system that covers issues such as environmental health, employee safety, handling and storage of chemicals and general safety issues. With the exception of chemicals very few manufactured goods are in themselves environmentally threatening. Since most industry is already in industrial areas this reduces the associated risks. In future the legislative framework should allow for better monitoring of manufacturers with potentially harmful products.

B2.3 ISSUES OF ENVIRONMENTAL CONCERN

Generally there are few issues of environmental concern about the manufacturing process itself beyond employee health and safety. These are monitored by the Ministry of Health and Social Services. Wastes produced from the processes are much more of a concern.

B3 INDUSTRIAL WASTE MANAGEMENT

B3.1 CLASSIFICATION OF INDUSTRIES BY TYPE OF WASTE AND DISCUSSION OF WASTE PROBLEMS BY TYPE OF WASTE

This information originates in various documents and interviews which have been consulted.

Table B8: Type of waste by industry

Solid	Noise	Liquid	Air
Food processing	Wood products	Food processing	Food processing
Tanneries	Metal products	Tanneries	Tanneries
Paper and printing products		Paper and printing products	Non metallic minerals
Chemical products		Chemical products	Metal products
Metal products		Metal products	

Table B8 has been compiled in line with the interviews and literature review undertaken and focuses on the main problems. This then leads to some idea of which sorts of solutions are required. Noise can mainly be dealt with by zoning. The draft pollution legislation makes provision for this and for measures to control noise, that can be exercised at local level. Other types of pollution will in one way or another also fall under the forthcoming pollution control and waste management bill. Solid wastes can normally be dealt with in dumps, subject to an appropriate dumping site being available. Liquids may require pre treatment before depositing into the normal waste water system, or special collection in the case of many chemicals. The ZERI project being considered to treat waste from Windhoek's northern industrial area is an example of an industrial area with a dedicated waste treatment system making it feasible to have dedicated treatment facilities. Air pollution can be dealt with by a combination of zoning and emissions standards. All of these solutions imply a substantial involvement of the municipalities in controlling industry. The peculiar circumstances relating to the Montreal Protocol (concerning ozone depleting substances) are listed under their own heading.

B3.1.1 Solid waste

This at present falls under the jurisdiction of the municipalities. A recent study examining it (Hochobeb 1999 in draft) has concluded that waste management on the level of most municipalities is extremely poor. This will in future be regulated by the forthcoming Pollution and Waste Management Act. Two particular problems which repeatedly came up were the problems of hospital waste (in rural areas and in some towns) and abattoir waste causing human health hazards. Some solid waste is already being recycled. This includes sludge from dissolved acetylene production used for paint, polypropylene animal feed sacks used for charcoal packaging, paper and metal collected and sent to South Africa for recycling and recycling of oil in Walvis Bay.

B3.1.2 Noise and air pollution

The problems in this area are mainly related to the location of the plant. In particular there have been repeated mentions of the air pollution due to the cement factory at Otjiwarongo.

B3.1.3 Water

In so far as this directly effects human health it is the jurisdiction of the Ministry of Health environmental health inspectors at present, who receive water samples from NAMWATER which give bacteriological analysis. The Department of Water Affairs has general jurisdiction over water waste, and issues effluent permits. These are issued to municipalities, and outside their boundaries to individual operations. These are monitored through yearly visits, sometimes with officials of the Ministry of Health or the Ministry of Works. Municipalities tend to have reasonably good compliance to their permit requirements (Nikodemus pers.comm.) with a few areas with completely overwhelmed systems due to urban growth, in particular Oshakati. It is reported that

some places fail to comply several years in a row despite being sent warning letters. In addition to compliance problems several organisations are worried about dumping into the water supply of various diverse chemicals from small industries. Oil within Windhoek is collected by the Council and sold to Rossing Uranium who use it for igniting dynamite. In many other towns collection of waste oil and other hazardous products is non existent.

Several stakeholders have expressed worry that the consulting firms being used to do feasibility studies for water treatment are standard solutions not ones which are technically and financially feasible. A rough analysis of the costs of different treatment options presented for Oshakati indicates that one of the options may not be viable due to it costing around 2% of average per capita incomes[15].

B3.2 COMPLIANCE WITH EIA

No legislation at present forces compliance with EIA or even requires them to be done with the exception of mining legislation. The Environmental Assessment Policy and the draft Environmental Management act lay done principles of environmental management, which include:

- Public participation in decision making
- The application of the precautionary principle
- Preservation of Namibia's biodiversity
- Use of best practicable environmental options to reduce waste
- Application of the polluter pays principle

In addition the draft Pollution Control and Waste Management act will establish an agency to regulate and control pollution in Namibia. This will operate using similar principles to the Environmental Management Act. This section then examines the compliance with these principles by various sectors.

[15] Willingness to pay for water supply in total is often assumed to be around 5% of income, as a rule of thumb. The author hasn't had time to find equivalent amounts for sanitation.

B3.2.1 Public participation in decision making

There are a number of cases where it appears the public is concerned or unhappy about the operation of establishments and that this may be due to there not having been sufficient consultation on manufacturing developments. These include the smell problems from the tanneries north of Windhoek and from fish processing in Walvis Bay, and the dust problems in Karibib and Otiwarongo from their mineral processing. Although there have often been formalised consultations during Environmental Impact Assessments public participation is not guaranteed in the policies that will effect manufacturing development. This potentially raises a large number of issues relating to where would be most beneficial for industry to be located within municipal areas. In addition there Environmental Impact Assessments at present only relate to new developments or expansions.

B3.2.2 Application of the precautionary principle

Interpretation of this principle is difficult given the absence of certainty on most environmental problems. However it is clear that there are a number of manufacturing industries which are developing which could plausibly create environmental problems (for instance chemicals and tanneries) through a number of types of waste (solid, liquid etc) but have not had much control beyond existing sectoral controls. The fact that most establishments are producing waste without any idea of what might be environmental consequences suggests that the precautionary principle in practice is not applied by most manufacturing industry in Namibia.

B3.2.3 Use of best practicable environmental options

This principle is adhered to by many companies in that they are making an attempt to take into account environmental issues without compromising the integrity of their businesses. This is obviously true of the biggest companies such as Namibia

Breweries and companies which are parts of multinationals which often have their own environmental policies (e.g. Afrox). It is clear however that many do not have access to information on the technology available for the reduction of waste, even when it may be cost efficient, as the DANCED funded study of the fish processing industry made clear. The lack of quality dumping sites in most towns for solid waste, plus the lack of capacity among many town councils to control liquid and air pollution suggests that best practicable environmental options are not being used by municipalities despite their availability and application in some Namibian towns. In addition some individual tanneries have an obviously bad compliance record by not having permits for discharging effluent and by discharging hazardous chemicals and chrome into the water. Since they have improved their records recently and continue in business it can be concluded that they were not applying best practicable environmental options in the past.

B3.2.4 Application of the polluter pays principle

This principle is barely applied at all through legislation or general government policies. Although polluters are responsible for payment of fines and for testing of water as well as pre treatment of effluent, they rarely have to pay for anything else related to their impact on the external environment. Virtually the only exception encountered by this study is the application of effluent charges (related to quality and quantity of effluent) by Windhoek municipality. The case in environmental economics for pollution charges is very strong when monitoring problems can be overcome. So while it may be desirable to subsidise collection of toxic waste (so as to discourage illegal dumping), it might be also desirable to tax waste where it can be monitored fairly easily. On these grounds many countries have taxed leaded petrol more heavily since the input (leaded petrol) necessarily leads to an output (lead in the air), so as to encourage the use of unleaded petrol. While this may not be a perfect solution (if only because the influence of lead in the air on health will be very different by location) it is probably a good second best solution. The draft pollution control and waste management bill makes provision for these charges.

B3.2.5 Summary on EIA compliance

Lack of data and standards make this area rather difficult to assess. Unlike mining manufacturing has not generally been subject to EIAs in the past due to the lack of legislation. Some major projects have had EIAs, which have broadly incorporated the principles outlined above. Smaller projects, including diverse small manufacturers such as welding and printers, will not be subject to EIAs in future despite the fact that they may have adverse environmental consequences. In these cases, particularly given the fact that most environmental problems are inflicted on the locally resident communities rather than the nation as a whole, the appropriate institution is the municipality or the Regional Council (this is made provision for in the draft legislation). In addition these institutions are probably more responsive to their communities since they are closer to them. Some municipalities are clearly more aware of these problems than others. Hence compliance to EIAs can be judged in terms of the ability of these institutions to incorporate these principles into their operations and to comply with sectoral legislation on water quality. Comments from the Division of Water Quality indicate that government institutions are often the worst offenders in terms of water pollution.

B3.3 WASTE CONTROL AND MANAGEMENT, STORAGE, DISPOSAL METHODS AND COSTS INVOLVED, POLLUTION, RISKS, ENVIRONMENTAL CONCERNS AND PROGRESS

B3.3.1 Food and beverages

MOHSS monitors the use of radioactive substances by some food manufacturers. Most beverage manufacturers are trying to limit effluents due to charging by Windhoek municipality for effluents and the cost of the water which is lost when effluents are released. Namibia Dairies, as an example, has a heat exchange system to save water, while the entire design of the Namibia Brewery in Windhoek is designed to minimise water use. Evaporation ponds are also used by Namibia Dairies to reduce effluents put into the municipality system. The cost of the new systems in Namibia Dairies, which will reduce waste and water use further will be around N$8 million, but is financially justifiable for the company given its expansion and that the company needs to install new equipment anyway. While Namibia Breweries was constructed at a time of water shortages, and so is a world leader in water use reduction in beer production. The cost of this is not known.

B3.3.1.1 Fish processing

Fish processing has mainly pumped its waste (in the form of water carrying pieces of fish) into the sea at Walvis Bay and Luderitz. Occasionally there has also been dumping on land of solid waste. This has been very cheap for the factories. Pollution of the area around Walvis Bay by fish processing has occurred (O'Toole:20 & 27). The main problems have been due to the discharge of effluent into Walvis Bay. This has led to the Bay becoming polluted enough for the factories to need to install water purification equipment so that they are able to use water from the Bay for their processing. The pollution is intense but localised, however *"monitoring of the water quality in Walvis Bay has to date not indicated pollution levels which have any more than localised impact. In addition, species diversity of shorebirds on the mudflats of Walvis Bay lagoon has changed little since biannual bird censuses began in 1983. However, the proximity of the harbours and fish factories at Walvis Bay and Luderitz suggest that the lagoon communities may be vulnerable"* (National biodiversity

study:207). In addition to the problems at Walvis Bay and Luderitz there have also been problems at Arandis where fish processing has led to effluents being released improperly, containing organic wastes and salts used for drying of the fish.

In this light a DANCED funded project on clean technology in the fish processing industry has been initiated to reduce water use and waste from the fish processing industry. This has led to improvements in the technology used in three factories in Walvis Bay, which deal with canning, white fish and fishmeal. The improvements used have cost between N$114,000 and N$546,000 per factory. If the high end cost is taken for all of the industry's factories this equates to a cost of N$10.9 million for the entire industry, compared to value added in the fish processing industry of N$519 million. The project subsidised 40% of the cost, and the fish processing companies paid the other 60%, which implies that the savings (through lower water costs and higher proportion of the fish used) were worth the investment[16]. If this is the case the net cost to the industry as a whole[17] could be well under N$5 million even excluding the reduced cost to the industry of cleaning the water intake from the Bay. The potential impact is to reduce discharge of effluent by 30% and the effluent load by one third. In addition the Walvis Bay municipality has started to enforce effluent regulations more tightly. Some fish waste at present is recycled by being used as an input to animal feeds.

There is a project planned by DWA that may fit into this which will establish ambient qualities of water in the Bay, define a quality based on the quality outside the Bay (R.Roeis pers.comm.). This may lead to a central waste treatment facility with charges based on quantity, quality (in form of several parameters such as organic content). This would lower the total costs to the manufacturers of treating their waste.

The progress in the fish processing industry is encouraging given the potential of the fishing industry to more than double (in weight terms) and the fish processing industry to increase in size by more than this as more processing is undertaken on shore within Namibia.

[16] The fish quotas are now allocated to fishing companies with some consideration of environmental responsibility. The existence of large resource rents (Lange and Motinga 1997) means that these are very profitable so that even if savings from environmental responsibility are low they might be a good investment in securing quotas.
[17] Assuming that the canning plant is not unusual compared to a typical factory.

B3.3.1.2 Meat processing

Meat processing takes place in several large locations such as Meatco's operations as well as in small operations in most Namibian towns. This potentially leads to several undesirable problems which are: Smell; Smoke; Solid wastes and sludge and Liquid wastes. At the most sophisticated end of operations such as in Windhoek, waste water is pre treated and then finally treated at the Ujamms plant. This takes waste from Meatco and Hartlief, but is sometimes overloaded. The cost of future waste treatment means that the manufacturers who are at present using Ujamms are supporting the Zero Emissions Research Initiative which will use waste from their plants for various types of agricultural production. ZERI is projected to actually generate funds, and is based on technology which is widely used elsewhere. The manufacturing companies involved see it as much cheaper than internal clarifying pools and other plant based treatment so are actively supporting the initiative in collaboration with the University of Namibia and the Windhoek municipality. Other wastes reported are small quantities of smoke from the smoking process, air pollution from the use of heavy duty oil, fat, blood, small quantities of meat solids and salt. These potential problems are mainly related to zoning and waste water treatment. In problem areas such as Outjo there is a problem with waste and smells. It has also been suggested that the Mariental and Keetmanshoop abattoirs do not keep to the conditions of their permits, since their evaporation ponds are not lined properly and there is not proper pre treatment (Roeis). Tallow from abattoirs is used as an input in animal feeds.

B3.3.1.3 Beverages

Few problems heard of especially with Nambrew's reduced water consumption. It should be noted that the actual liquid content of beverages is only around 10-25% (Groom et al) of the water used. Even so even a very large producer will only use a moderate amount of water. NAMBREW is one of the factories sending effluent to Ujamms which is sometime overloaded. The Vunguvungu dairy in Kavango has been reported as problematic due to having oxidation ponds which are on the flood plains of the Okavango river, leading to floods sweeping away the polluted effluent.

B3.3.1.4 Other food product

Bakeries have no problems reported, although it has been noted that in some other countries there have been problems with bakery smells. The waste from Namib Mills in Windhoek, Otavi and Katima Mulilo is entirely recycled by Feedmaster to produce animal feed. Sweepings from Feedmaster are used in the feedlot at Meatco. Plastic from Feedmaster is being used for packaging charcoal, and reductions are being made by transporting feed in bulk.

B3.3.2 Textiles and leather

Tanneries have a number of reported problems due to the nature of their processing. These have been mentioned by almost all government officials interviewed. Problems experienced in Namibia have included Chrome (and potentially other pollutants) seeping into the groundwater near Brakwater and complaints about smells. Tanneries use evaporation ponds to dispose of effluent when they are outside municipal boundaries, and there may have been problems with seepage due to imperfect sealing. In addition tanneries have been observed not even observing basic procedures for effluent storage and even discharging effluent into riverbeds.

Two tanneries were noted inside municipal boundaries, Swakopmund tannery and Nakara tannery in Windhoek, which both produce effluent clean enough to comply with municipal regulations (Ashipala and Roeis pers.comm.). The poor management of waste at one tannery led to it being prosecuted for pollution of groundwater. The two tanneries north of Windhoek which have had repeated problems now have a special project to monitor their effluent and borehole water to each side of the tanneries. They have also received technical assistance from the Leather Industry Research Institute, and have followed the upgrading proposals which were presented. One of the tanneries is at present closed for the installation of a new purification system. A recent technical report on the possible establishment of a tannery near

Oshakati has noted the need for project design to comply with Namibian policy and law (UNIDO 1998b) due to the potential problems with its present design.

No problems have been reported from any textile operations.

B3.3.3 Wood products

Limited noise and dust at places like MKU mean that with correct zoning there are no problems. Charcoal production produces smoke which is a health hazard. Again with proper zoning and simple regulations (for instance a smoke stack when appropriate) this should not be a major problem.

B3.3.4 Paper products

There are several firms specialising in collection of waste paper and cardboard, which is sorted and sent to South Africa for recycling. Companies are often willing to collect their waste in special paper bins so that they reduce the cost of their waste removal. It seems unlikely that there will be a paper pulping plant in Namibia in the near future due to overcapacity in South Africa and the water intensity of the industry. However there will be a fruit tray production plant in Namibia by the end of 1999. The paper production has very limited wastes, relating to dust from paper cutting.

Printing chemicals are the main non paper waste from the printing industry. Hazardous chemicals are returned to the suppliers, who source their inputs from South Africa. Non hazardous chemicals are put in the drainage system.

B3.3.5 Chemical products

There are potential problems of leakages from paint chemicals, and due to the use of chemicals in a variety of processes related to manufacturing generally. The one chemical plant visited was recycling its sludge waste to provide free paint for government housing schemes. It has not been possible to verify this directly (which would have required visits to all chemical factories) but it appears that there are very few sites actually producing chemicals themselves, but that most of them are mixing or decanting imported chemicals.

B3.3.6 Non-metallic mineral products

Crushed marble and cement are potentially serious problems, as are brick production and asbestos. These are though mainly problems which fall under the human health regulations and are thus under responsibility of MOHSS. As with many other industries the most effective method of control is zoning. Removal of white rocks in the hills around Windhoek has also been mentioned as a factor contributing to dustiness in Windhoek.

B3.3.7 Metal products, machinery and equipment

These products mainly produce wastes related to the cutting and shaping of metals, hence gases from welding, scrap metal (which is recycled) and oil, which is collected by the municipality in Windhoek. Several sources have mentioned a problem from dust from sandblasting in Walvis Bay. One company had had complaints from its neighbours and had changed from using sand to platinum grit, which both improved the quality of its products (by reducing rusting) and in the long run reduced costs since the grit can be recycled.

B3.3.8 Other

No problems were reported by any sources concerning manufacturing that fell under this category.

B3.4 RECYCLING

The cost of raw materials imported from South Africa makes recycling more viable for those materials were it is feasible to establish a Namibian plant, but less viable for those where the materials have to be transported back to South Africa for recycling. Many manufacturers visited are paying for their waste to be removed by private companies, who are sorting the waste for recycling. In particular a lot of high quality paper is being collected. Waste oil collected by Windhoek municipality is sold to Rossing mine. Waste metal is also reportedly recycled by scrap metal dealers who are collecting waste from both domestic sources (such as municipal dumps) and from manufacturing firms.

B4 MUNICIPALITY DUMPING INFORMATION

As discussed above the impact of different industrial processes means that catering for the different wastes produced by different types of manufacturing is not possible in Namibia. The forthcoming legislation on pollution and waste control will establish an agency to deal with pollution and waste control. The Ministry of Health at present has regulations dealing with worker's health which are adequate[18]. There are however issues surrounding:

- Emissions into the air that effect communities (MOHSS)
- Solid waste in municipal dumps
- Liquid waste (MAWRD enforcement issues)

Since there is already a ministry with responsibility for air emissions it has been decided to not pursue this as a major environmental issue. In addition since most of these problems relate to enforcement of regulations and zoning it is anticipated that after the key environmental legislation is passed air pollution will not generally increase as a problem. However the liquid waste and solid waste issues have further implications. Pollution of groundwater could lead to the need to develop new water supplies, and as recent increases in water prices show this is sometimes very expensive. Solid waste can produce pollutants that effect the groundwater through leaching and directly effect the health of people if they have to pass through dumping grounds, as they do in Rundu.

B4.1 WINDHOEK

Windhoek has a series of dumps, which cater for domestic waste, road sweeping, road cleansing as well as general and hazardous waste generated from businesses including manufacturing. Due to the predicted growth in industry in Windhoek the waste control facilities are of great importance. General waste is disposed of at

Kupferburg, which is nearing the end of its 60-70 year life span. In addition there is a lined hazardous waste cell at Kupferburg, with a life span of around 10 years. The costs of running the site itself are around N$1.2 m a year, excluding the hazardous waste costs from industry, which are around N$800,000 per year. Once the costs of constructing a new site, and in particular the hazardous waste cells, are included the cost per resident per year is around N$90-100, in other words around 1% percent of income[19]. This ensures that at present Windhoek has a reasonably good site with toxic waste disposal well dealt with, as shown by the lack of evidence of any water pollution from Kupferburg. Hence with future growth of industry reducing costs of waste disposal will not be critical but will be significant. The municipality alone would save around N$1m a year if the planned new waste facility was 11 km from the city rather than 15 km. The importance of Windhoek's aquifers to its water supply are both in their usefulness as a non evaporating water supply and in their cheapness compared to other supply options. Given the geology of Windhoek this means there is a tradeoff in finding a new waste site between a place which is cheap to operate due to its location and the risks of polluting the water supply. The compromise with Kupferburg was to build on a geologically imperfect site, but to be particularly careful with the level of lining of the hazardous waste cell. There are also environmental costs of transporting waste over large distances (fuel consumption and accidents in particular) as well as non quantified costs to businesses in the waste disposal industry that do so.

Hazardous waste is by far the most expensive type of waste to dispose of, needing a new cell every 10 years, costing about N$10m as well as handling costs of several hundred thousand dollars a year. However this waste is very skewed by type as **Table B9** illustrates:

[18] These are based on the Labour Act.
[19] Average income per capita was around N$8885 in 1993/4. No information is available on incomes since then.

Table B9: Composition of hazardous waste in Windhoek

Type	Percentage of total
Meatco sludge	64.8%
Tannery sludge	13.7%
Namibia breweries	0.0%
STW	16.2%
Solvent from paints	0.5%
Industrial oils	1.2%
Miscellaneous chemicals 1	0.2%
Miscellaneous chemicals 2	0.5%
Other miscellaneous	0.5%
Infectious waste	0.2%
Animal carcasses	0.6%
Condemned food	1.5%

Hence the overwhelming amount is from Meatco, the tanneries and the sewage treatment works (STW). As mentioned above Meatco can be expected to keep on growing, but on the basis of recent years at less than 3% a year. The tanneries may produce higher growth, given their potential to produce a high value added product. The rest can be expected to grow with population and manufacturing. The application of the polluter pays principle is approved in principle by the municipality, so that the implications of further hazardous waste production are not very serious. If Meatco starts to send its waste to the ZERI project then a hazardous waste cell that at present lasts ten years might last up to 25 years, depending on the urban and manufacturing growth rates. In addition there is a feasibility study being undertaken of an incinerator to burn waste to produce electricity. Given the present need for a new hazardous waste site within the next three to six years it is difficult to assess the true long run cost of hazardous waste. A minimum might be taken to be the present cost (assuming that electricity generation is not viable) while a maximum might be taken as the transport cost if the waste was transferred to a location 50 kilometres away. An approximate extra cost of transporting this a year would be N$250,000, which in comparison to manufacturing's value added in Khomas is very small. Hence, regardless of location of waste dumps and development of manufacturing, the costs of hazardous waste disposal are likely to remain manageable as long as the municipality continues to maintain capacity to deal with hazardous waste.

B4.2 WALVIS BAY AND SWAKOPMUND

The present Walvis Bay site is of a reasonably well managed dump which has been in operation for 35 years and is about two kilometres from the town. The climate of the area means that with suitable separation of oils (which is already attempted) there should be few problems of leachate. At present there has been some contamination of the groundwater by ammonia, iron, lead and mangenese enough to exceed SABS 241 Drinking Water Criteria standards. However this is localised and does not effect any aquifers used for the town's water supply. Plans, which are well advanced, exist to adapt this site to cater for the next 30 years of growth. The plans make provision for protection of groundwater (the site's location means that the groundwater gradient is favourable) mainly through separation of hazardous wastes in a special facility. This will allow for incineration of medical waste, as well as general hazardous waste. This facility will be situated on top of an old dumping area so that even with a failure of the entire lining system there will be 12 metres of dry waste between the hazardous waste and the groundwater. There is a draft Environmental Monitoring and Management Plan which will monitor groundwater quality and attempt to keep the surrounding desert habitat in a reasonable state, as well as to prevent health hazards to workers and members of the general public. The site will in addition have a section for recycling stalls which can be leased to contractors who can store and sort materials before moving them offsite. The cost of this entire project is N$3.5m, which equates to a total cost of around N$29 per resident per year,[20] which is around 0.4% of per capita incomes,[21] which is reasonably low. It should be noted that this level of cost cannot be paid by some towns from their own resources, Erongo has a high average per capita income and a reasonably large and growing town to spread the cost over[22].

Swakopmund by contrast to Walvis Bay has a more typical dumpsite, which is unfenced with irregular burning and a lot of waste being blown away. When the

[20] This is the present value of the capital cost divided by the number of residents discounted at a 10% rate, with an assumed 4% growth rate of the town. However although incomes per capita are assumed to remain constant and population is assumed to grow at 4% the operating costs are not assumed to rise. If they are assumed to rise in line with population then the total cost is equal to around 0.5% of per capita incomes.
[21] This is a 1993/4 per capita income figure inflated by 50% to give the 1% estimate.
[22] For a town of 5000 people with a 3% growth rate in Oshana (the median region for human development and per capita income) the capital cost is 2% of per capita incomes. This may appear low but 5% of per capita incomes is a benchmark often taken for the willingness to pay for clean water. It may well be cheaper to simply relocate hazardous waste to larger towns.

State Hospital's incinerator is not working medical waste is transported to Walvis Bay.

B4.3 OKAHANDJA AND OTJIWARONGO

Okahandja has one general dump as of the survey by Tarr 1997?. Hospital waste from Otjiwarongo is incinerated at Okahandja when the Otjiwarongo incinerator is not is not working. Some hazardous chemicals in Otjiwarongo are being stored for future disposal. The general dump at Otjiwarongo is using the normal method of burning and burying waste, but again due to lack of a fence waste is blown away from the site.

B4.4 OSHAKATI, ONDANGWA AND OSHIKANGO

The Oshakati dump is again a very general dump, but with removal of metals, batteries, cans and bottles for recycling purposes. Oil is removed for recycling to Walvis Bay. Very little else has been ascertained, beyond plans to improve sewage systems in Oshakati. Ondangwa has an open dump. Oshikango has no dump at present, but one is being established for the general area by Ohangwena Regional Council.

B4.5 OTHER TOWNS

Hochobeb 1998 and Tarr 1997 provide an overview of the following towns: Gobabis, Grootfontein, Henties Bay, Karabib, Karasburg, Katima Mulilo Keetmanshoop,

Khorixas, Luderitz, Mariental, Okakarara, Omarurua, Ondangwa, Opuwo, Otavi, Outjo, Rundu, Rehoboth, Swakopmund, Tsumeb and Usakos. Almost all have a general dump with no other waste facility. Most have abattoirs, with the Outjo municipality in particular reporting problems from abattoir waste. Gobabis has an abattoir specific dump, while a couple of towns have a building rubble specific dump. Given the cost of running and constructing a dump which is suitable for all hazardous waste, as well as the concentration of manufacturing in a small number of towns the most appropriate mechanism is that which already exists in practice in some towns, which is that hazardous waste is transported to Windhoek or Walvis Bay for disposal. The growth of industry in the Oshakati area could make it cost effective to build a specialised facility there as well.

B4.6 GENERAL MUNICIPAL CAPACITY

Municipalities have a wide range of jurisdictions which cover dumps, waste water treatment and general environmental health. In addition as the unit of government closest to people living in their boundaries they are the natural institution for people to complain to when there are problems. Many stakeholders have suggested them as key focus for environmental management. This is supported by the author due to the simplicity and cost effectiveness of this approach and has led to the development of indicators based on this. There is also some ability to make efficiency savings in municipalities due to the need for upgrading of domestic waste water systems as urban growth continues. It should also be stressed that many people have mentioned the generally high level of by laws enforcement and general capacity of the Windhoek and Walvis Bay municipalities. Small scale industry outside municipal boundaries contributes relatively little to output in general but has been mentioned as a potential problem in places such as the small scale abattoirs near Brakwater.

B5 MUNICIPAL WATER INFORMATION

As is the case with solid waste most responsibilities regarding water quality rest with the municipalities. Municipalities receive permits from the Department of Water Affairs, and also provide samples for testing for organic contamination by the Ministry of Health and Social Services. Hence in principle the mains threats to human health are dealt with this way.

Organic pollutants are typically within the normal waste water disposal system of the municipalities. If these are not functioning properly there is still a relatively low risk, as long as the ponds are sealed properly, since most of the contaminated water will evaporate, rather than overflow and contaminate surrounding areas as it would in a wetter climate. A more important risk is that the fences surrounding oxidation and evaporation ponds are frequently stolen, meaning that people and animals have access to areas which contain water with organic pollutants. In several towns it is reported that this is happening, however these problems are due to an inability of towns to cope with waste water generally since waste water from manufacturing is almost certainly a very small proportion of total waste water[23]. The only place in Namibia where organic wastes from manufacturing are certainly responsible for pollution problems is in Windhoek, where the Ujamms treatment works is sometimes unable to cope with the effluents. This particular problem will be dealt with by the ZERI project.

In the light of the discussion above the main threat in practice is municipalities with weak capacity in general and in particular the issue of non organic pollutants. Non organic pollutants are particularly difficult to deal with, since they originate from not only manufacturing but also domestic use of various chemicals for things like cleaning. Many chemicals which are harmless in small quantities, such as some photographic chemicals, might become dangerous if manufacturing expands. Unlike organic pollutants it can be very difficult to remove these from water, particularly since they may not be detected unless they are searched for. Discussions with stakeholders have led to the suggestion that water recycling should be limited to a

[23] This statement is made on the grounds that water used by the manufacturing sector is only a small proportion of total water use (Lange 1997).

fixed percentage of water used, as it is at present in Windhoek. In addition separating industrial waste water with its own treatment facilities, as is done in Windhoek's northern industrial area, helps to reduce this risk. As with solid waste these measures are much more cost effective to undertake in large towns, again underlining some of the benefits of agglomeration.

B6 OZONE DEPLETING SUBSTANCES

Namibia is a party to the Montreal Protocol of the Vienna Convention, regulating protection of the ozone layer. Namibia uses small quantities of ozone depleting substances (ODSs) and has a national plan in place to phase them out by 2003 (MTI 1996). Major users are overwhelmingly refrigeration (92% in 1994) with portable fire extinguishers making up most of the balance. Refrigeration is mainly used by the food processing and trading industries, as well as a small amount of domestic use. The use of ODSs cannot be considered a serious problem in terms of Namibia's tiny use of them and the fact that use will be phased out within 4 years.

B7 POTENTIAL INDICATORS

Definition of indicator	Data collection and calculation	Uses of indicator	Discussion/ evaluation
Manufacturing / GDP	CSB statistics	Indicates size of sector and hence contribution to jobs and taxes	Problematic what an increase means from environmental point of view
Diversification of manufacturing	CSB and MTI census	To show ability to withstand shocks and to increase growth	But not particularly env.
Manufacturing share of exports	CSB	To show the ability of the economy to withstand economic shocks due to commodity prices or the weather	The present situation of Namibia's linkage to the Rand means that for the present the exchange rates effects are not important, however the effects of commodity prices on employment and government revenue continue to be significant
Location in relation to physical infrastructure	MTI surveys, phone directories?	Availability of inputs and risks related to them	Could be altered to mean % of industry in towns with good waste management systems
Cost of waste disposal in relation to value added	Municipalities	To show increasing / decreasing recycling, effluent dropping and waste reduction	Problem that a) data not available and b) dropping costs can be due to non compliance or moving to lower areas of monitoring
Effectiveness of policy and legislation	DWA reports on warning letters and prosecution and on % of establishments with permits Or compliance with EIA recommendations	To show compliance with regulations/ legislation	So long as enforcement capacity does not radically alter this is a good one

Definition of indicator	Data collection and calculation	Uses of indicator	Discussion/ evaluation
Informal food processing law		To show proportion of informal food processing activities registered	No good rationale to this
% of employed LF in manufacturing	CBS, MoL, MTI	To show job creation by manufacturing	Job creation positive – but links to environment? Data may be periodic
% of population relying on income from manufacturing	CBS, MoL, MTI	To show total impact	Essentially shows the same as above unless family sizes and structures are different – data could be problematic
Volatility of manufacturing	CBS	To show diversification	Useful in showing the diversification of incomes of people but probably less informative than other diversification variables
Capital formation / total GFI	CBS	To show investment in manufacturing	Not much rationale
HIV infection rate in urban areas	MoHSS biannual survey	To show ability to curb negative side effects of urbanisation associated with manufacturing	This is an important topic, but urbanisation is not at present driven by manufacturing. It should be considered again in future
Human health in manufacturing	MoHSS	To show lack of negative effects from manufacturing	Only serious occupational hazards are caught in morbidity and mortality statistics, while prosecutions are very dependent on enforcement ability which is said to be weak
% of employees in large firms which are members of NNCCI	NNCCI	To show the organisation of large scale industry and ability of them and government to find mutually acceptable solutions to enviromental issues	The data is available but whether this has a direct bearing on manufacturing environmental issues is questionable.

Definition of indicator	Data collection and calculation	Uses of indicator	Discussion/ evaluation
% of employees of large firms who are unionised	Trade Union federations	To show the ability of workers in firms to protect their health	Data availability by plant might be problematic
No of registered informal manufacturers	Agronomic board, wood carvers and the JCC	To show organisation of small scale industries and ability of them and government to find mutually acceptable solutions to enviromental issues	The data is available but whether this has a direct bearing on manufacturing environmental issues is questionable.
Prosecutions for violation of waste legislation	Pollution and waste control agency	To show compliance to waste/ pollution standards	This data will not be available for several years, but in the long run (once there is consistent application of the law) will be a useful indicator
Urban pollution	Pollution and waste control agency	To show compliance to waste/ pollution standards	This data will not be available for several years but will eventually be useful as an indicator of the urban environment
Revenue from pollution charges as a % of total revenue of government	Ministry of Finance	To show application of the polluter pays principle	This will only be collectable once these sorts of charges start being made by central government
Proportion of industry in towns which have a waste disposal systems for oil	MET Pollution and waste control programme and MTI industrial census	To show the fulfilment of a basic waste management option	The data will not be fully available until the waste management agency is established, but can be monitored in the interim
Proportion of large manufacturing companies in formal industrial areas	MTI databases	To show they are in areas that minimise their negative impacts and increase chances of keeping to rules	

Definition of indicator	Data collection and calculation	Uses of indicator	Discussion/ evaluation
Water regulation violations	DWA reports	To show the number of instances in a year when DWA has sent out warning letters on violation of the water act	This is dependent on a constant regime of enforcement and only focuses on one resource
Proportion of industry in towns with dumps of sufficient quality and location and suitable water treatment	DEA Pollution and waste management programme	To show the proportion of towns which have generally reasonable waste management	This doesn't show all aspects of the environment or even waste but does give an idea of the capacity in existence.
Number of new dumping sites established in areas with an appropriate location and stakeholders discussions	DEA Pollution and waste management programme and EA programme	To show that new dumps are being established in appropriate locations that do not threaten human health or the environment	This depends on qualitative judgements and the significance of a new dump in an inappropriate area in a small town is obviously different from that in a large town
Full cost of operating dumpsites in major industrial towns	Municipalities and private waste contractors	To show that the cost of running dumps is not too high	This depends on the key towns attaining and maintaining high standards. It also requires data which would need to be specially collected from private companies

B9 SECTOR OUTLOOK

In summary it can be said that the manufacturing sector at present is experiencing gradual development. It is not at the growth rates of Newly Industrialising Countries, but is at least avoiding deindustrialisation which is occurring in many African countries. The main areas of growth in the near future will be fish processing, assuming fish stocks return to their long run sustainable yields, and "other manufacturing" which is a diverse sub-sector. The five year or so time frame of State of the Environment reports means that this focus has been adopted for the manufacturing sector.

APPENDIX B1

Table 15: Non fish food processing location by town

Town	Number of establishments
Aranos	1
Gobabis	7
Grootfontein	7
Henties Bay	1
Karasburg	3
Katima Mulilo	4
Keetmanshoop	5
Khorixas	1
Mariental	3
Okahandja	7
Omaruru	5
Ondangwa	1
Opuwo	1
Oshakati	3
Otavi	6
Otjiwarongo	7
Outjo	3
Rehoboth	9
Rundu	8
Swakopmund	7
Tsumeb	4
Uis	1
Usakos	2
Walvis Bay	3
Windhoek	33
Total	**132**

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